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GONIOBASES OF THE VICINITY OF MUSCLE SHOALS

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NINE species and two subspecies of *Goniobasis* are recognized in this paper as inhabiting the vicinity of Muscle Shoals, Alabama. I have not had the heart to count the names it has been thought necessary to throw into the synonymy, always a slough of despond in the case of the Pleuroceridae. The position of *Melania formosa* Conrad, for all its venerableness, is considered uncertain for reasons later to be recited. Three other species are in like situation. *Goniobasis fabalis* Lea, credited to the Tennessee River, and *Melania semicostata* Conrad, described as from "streams in North Alabama," belong probably to the drainage basin of the Alabama River. Certain Goniobases that are in the Alabama Museum of Natural History appear to be undescribed, yet it is believed to be best to leave them unnamed until they can be compared with the more obscure mollusks of the Lea and Anthony collections.

All the recognized Goniobases, with one exception, are plicate-striate, i.e., they have longitudinal ribs upon the apex that are crossed by revolving raised lines. *G. pybasii* seems to be plicate only. Two species that have been placed (with interrogation marks) in the synonymy of *G. paupercula* were described as smooth, but I am inclined to believe that, if uneroded specimens had been in the hands of the describer, they

would have been found to be plicate-striate. Hinkley mentions the finding near Florence of two smooth species, *G. aterina* Lea and *G. adusta* Anthony. The determination is probably in error, since these two species belong to the fauna of southwestern Virginia and eastern Tennessee rather than to that west of Walden's Ridge. I am unable to say what he collected, but since one of the smooth forms was found in a spring and the other in company with amphibious *Pomatiopsis,* it is likely that the shells were depauperate, as other Pleurocerids in similar situations frequently are. The *G. nitens* Lea which Hinkley lists with hesitation as from Florence also may be one of the phases of the local plicate-striate species, *nitens* being a synonym of *laqueata.* Nothing exactly like *laqueata* was found by Mr. Herbert H. Smith in the Muscle Shoals area outside the basin of Elk River.

The relationship of three of the nine Goniobases with others is vague. These are *G. paupercula* and *G. perstriata* plus *decampii.* Possibly their nearest connections are with forms of the Alabama River drainage basin, which have not been studied intensively. *G. nassula* belongs to the widespread group of which *G. catenaria* (Say) is the best known member. *G. acuta* and *G. baculum* are linked with *G. edgariana* (Lea) which in middle Tennessee seems to have a fairly close affinity with *G. laqueata. G. interveniens* of Alabama and *G. curreyana* (Lea) of Kentucky are closely akin. *G. pybasii* resembles *G. carinocostata* (Lea) of Coosa River tributaries.

The area which is spoken of in this paper as the vicinity of Muscle Shoals includes the tributaries of the Tennessee River from Jackson County, Alabama, on the east, to branches of it in Franklin County on the west. The Tennessee River at the shoals flows over the Ft. Payne chert of the Mississippi system. Mr. Smith collected here for several days in 1909 and in a letter to Dr. Walker described the river as "three miles wide, shoaly all the way across and full of little islands." He said that he had found no Goniobases in the river itself "except a few creek forms evidently washed in." This is as might be expected since much farther up the Tennessee and

even into the Holston and Clinch rivers, *Goniobasis* disappears and is supplanted by such large-stream forms as *Anculosa praerosa* Say and the various phases and varieties of *Pleurocera canaliculatum* (Say).

Acknowledgments for aid in the preparation of this paper are particularly due to Dr. Bryant Walker who opened his collection to me for examination, to the generosity of the Alabama Museum of Natural History in lending me its extensive material from the region of Muscle Shoals and, not least of all, to Mrs. Herbert H. Smith who made the selection of shells of the Alabama Museum, packed and dispatched them. Dr. A. E. Ortmann and the Hon. T. H. Aldrich were quick to respond to requests for information.

Goniobasis nassula (Conrad)

Melania nassula Conrad, New F. W. Shells U. S., 1834, p. 55, pl. 8, fig. 9; Lea, Trans. Am. Phil. Soc., VIII, 1841, p. 190; Obs. Gen. Unio, III, 1842, p. 28; De Kay, Moll. N. Y., 1843, p. 97; Wheatley, Cat. Shells U. S., 1845, p. 26; Jay, Cat., 4th ed., 1852, p. 274; Binney, Check List, 1860, No. 171; Reeve, Monog. Melan., 1860, sp. 412; Brot. List, 1862, p. 34.

Goniobasis nassula Conrad, Tryon, Smithson. Misc. Coll., No. 253, 1873, pp. 173, 193; Sargent, Nautilus, VII, 1894, p. 121; Price, Nautilus, XIV, 1900, p. 77; Hinkley, Nautilus, XX, 1906, p. 42; Goodrich, Nautilus, XXXVI, 1923, p. 116; Nautilus, XLII, 1928, p. 32.

Goniobasis thortonii Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268.

Goniobasis thorntonii Lea, Journ. Acad. Nat. Sci. Phila., V, 1862, p. 320, pl. 38, fig. 168; Obs. Gen. Unio, IX, 1863, p. 142, pl. 38, fig. 168; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 199; Hinkley, Nautilus, XX, 1906, p. 42.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

The typical form of this small mollusk is conic, thin, plicate on the upper half of the whorls, striate on all of them. The shell is grayish-yellow, carinate on the apex, slightly angled at the periphery. The sutures are rather deeply impressed. The aperture is ovate, bluish-white; the columella thin and narrow and consisting of only a wash of callus above the center; the outer lip incurved below the suture.

In one lot of *nassula* from the limestone spring at Tuscumbia, the type locality, 44 of the specimens are of the form

described; 4 are much narrower and have more pronounced carinae; 1 is like this, but is only slightly striate; 12 lack the striae on the base; in 17 the plicae are prominent and the striae microscopic; 8 are plicate and not striate at all. This last form was given the name *thorntonii* by Lea. It has been considered a distinct species by others also. But a careful examination of unsorted material from Tuscumbia shows quite clearly that the forms are of the same species. The extremes live in the same waters.

A marked variation from the typical form occurs in the Big Spring and the Graham Spring at Huntsville. This is quite dark, strongly carinate on the upper whorls; the striations are fewer than in the shells from Tuscumbia and do not occur on the base. It is a small race. Whereas in shells from Tuscumbia the striae tend to disappear and make the plicae stand out more sharply, it is the revolving raised lines in the Huntsville shells that persist and the plicae that tend to become obsolete. It should be said that the very young shells of the two localities are virtually identical except in the non-essential of color.

This species has been found also in the Tennessee River, apparently in the vicinity of Tuscumbia. There are certain very small and very eroded shells of the Flint River and Paint Rock River drainage basins that look very much like the *thorntonii* form of *nassula*. I have hesitated to place them there because their opercula are quite different from what is to be expected in the species under consideration. The *nassula* operculum is rather longer than broad and has the pronounced character of very loosely coiled spiral lines. This feature confirms the impression given by the sculpture of the shell that the species belongs to the group of *Goniobasis catenaria* (Say). This group is a highly interesting one and has a range extending from southern Virginia to eastern Texas. I have elsewhere discussed these Goniobases in detail.[1]

[1] Nautilus, XLII, 1928, p. 28.

Measurements of *Goniobasis nassula:*

Altitude		Diameter	
19	millimeters ×	8	Tuscumbia
18	millimeters ×	7½	Tuscumbia
17½	millimeters ×	8	Tuscumbia
17½	millimeters ×	7	Huntsville
16½	millimeters ×	7	Huntsville
15½	millimeters ×	6½	Huntsville

Goniobasis laqueata (Say)

Melania laqueata Say, New Harmony Dissem., 1829, p. 275; Am. Conchol., No. 5, 1832, pl. 47, fig. 1; Lea, Trans. Am. Phil. Soc., VIII, 1841, p. 181; Obs. Gen. Unio, III, 1842, p. 19; IX, 1863, p. 136; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 314; De Kay, Moll. N. Y., 1843, p. 97; Wheatley, Cat. Shells U. S., 1845, p. 25; Jay, Cat., 4th ed., 1852, p. 274; Binney, Reprint, 1858, pp. 143, 200; Reeve, Monog. Melan., 1860, sp. 281, 288?; Brot, List, 1862, p. 187.

Melasma laqueata (Say), H. & A. Adams, Genera, I, 1854, p. 300.

Goniobasis laqueata (Say), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 176; Pilsbry, Proc. Acad. Nat. Sci. Phila., 1896, p. 499; Walker, Misc. Pub. Mus. Zool., Univ. Mich., 1918, p. 158; Goodrich, Nautilus, 1923, p. 116; Nautilus, XLII, 1928, p. 32.

Melania castanea Lea, Proc. Am. Phil. Soc., II, 1841, p. 11; Trans. Am. Phil. Soc., VIII, 1841, p. 164, pl. 5, fig. 2; Obs. Gen. Unio, III, 1842, p. 2, pl. 5, fig. 2; IX, 1863, p. 145; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 323; De Kay, Moll. N. Y., 1843, p. 92; Wheatley, Cat. Shells U. S., 1845, p. 24; Reeve, Monog. Melan., 1860, sp. 337.

Goniobasis castanea (Lea), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 271.

Melania gracilis Lea, Proc. Am. Phil. Soc., II, 1841, p. 12; Trans. Am. Phil. Soc., VIII, 1841, p. 168, pl. 5, fig. 11; Obs. Gen. Unio, III, 1842, p. 6, pl. 3, fig. 11; IX, 1863, pp. 102, 125, 133; Journ. Acad. Nat. Sci. Phila., V, 1862, pp. 280, 303, 311; De Kay, Moll. N. Y., 1843, p. 94; Binney, Check List, 1860, No. 128; Brot, List, 1862, p. 38.

Potadoma gracilis (Lea), H. & A. Adams, Genera, I, 1854, p. 299; Chenu, Manuel de Conchyl., I, 1859, fig. 1968.

Goniobasis gracilis (Lea), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 178.

Melania monozonalis Lea, Proc. Am. Phil. Soc., II, 1841, p. 13; Trans. Am. Phil. Soc., VIII, 1841, p. 178, pl. 6, fig. 31; Obs. Gen. Unio, III, 1842, p. 16, pl. 6, fig. 31; De Kay, Moll. N. Y., 1843, p. 96; Wheatley, Cat. Shells U. S., 1845, p. 26; Binney, Check List, 1860, No. 168.

Melania decora Lea, Proc. Am. Phil. Soc., II, 1841, p. 14; Trans. Am. Phil. Soc., VIII, 1841, p. 181, pl. 6, fig. 38; Obs. Gen. Unio, III, 1842, p. 19, pl. 6, fig. 38; IX, 1863, p. 137; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 315; De Kay, Moll. N. Y., 1843, p. 98; Wheatley, Cat. Shells U. S., 1845, p. 25; Binney, Check List, 1860, No. 85; Reeve, Monog. Melan., 1860, sp. 292; Brot, List, 1862, p. 35.

Goniobasis decora (Lea), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 204.

Melania nitida Lea, Proc. Am. Phil. Soc., II, 1841, p. 14.

Melania nitens Lea, Trans. Am. Phil. Soc., VIII, 1841, p. 182, pl. 6, fig. 40; Obs. Gen. Unio, III, 1842, p. 20, pl. 6, fig. 40; IX, 1863, p. 126; Journ. Acad. Nat. Sci. Phila., 1862, p. 304; De Kay, Moll. N. Y., 1843, p. 98; Wheatley, Cat. Shells U. S., 1845, p. 26; Binney, Check List, 1860, No. 178; Brot, List, 1862, p. 36.

Goniobasis nitens (Lea), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 182; Hinkley & Marsh, Shells Cent. Tenn., 1885, p. 8; Hinkley, Nautilus, XX, 1906, p. 42.

Melania plicatula Lea, Proc. Am. Phil. Soc., II, 1841, p. 14; Trans. Am. Phil. Soc., VIII, 1841, p. 182, pl. 6, fig. 41; Obs. Gen. Unio, III, 1842, p. 20, pl. 6, fig. 41; Jay, Cat., 4th ed., 1852, p. 274; Brot, List, 1862, p. 34.

Melasma plicatula (Lea), H. & A. Adams, Genera, I, 1854, p. 300; Chenu, Manuel de Conchyl., 1859, I, fig. 1998.

Melania circincta Lea, Proc. Am. Phil. Soc., II, 1841, p. 15; Trans. Am. Phil. Soc., VIII, 1841, p. 187, pl. 6, fig. 51; Obs. Gen. Unio, III, 1842, p. 25, pl. 6, fig. 51; De Kay, Moll. N. Y., 1843, p. 99; Wheatley, Cat. Shells U. S., 1845, p. 24; Reeve, Monog. Melan., 1860, sp. 289; Brot, List, 1862, p. 31.

Goniobasis circincta (Lea), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 200.

Juga circinnata (Lea), H. & A. Adams, Genera, I, 1854, p. 294; Chenu, Manuel de Conchyl., I, 1859, fig. 2015.

Melania circinnata Lea, Binney, Check List, 1860, No. 54.

Melania deshayesiana Lea, Proc. Am. Phil. Soc., II, 1842, p. 242; Trans. Am. Phil. Soc., IX, 1842, p. 24; Journ. Acad. Nat. Sci. Phila., V, 1862, pp. 313–318, 323–325; Obs. Gen. Unio, IV, 1848, p. 24; IX, 1863, pp. 135–141, 145–146, 167; De Kay, Moll. N. Y., 1843, p. 98; Wheatley, 1845, p. 25; Jay, Cat., 4th ed., 1852, p. 273; Binney, Check List, 1860, No. 88; Brot, List, 1862, p. 34.

Melania deshayesii Lea, Reeve, Monog. Melan., 1860, sp. 330.

Melasma deshayesiana Lea, H. & A. Adams, Genera, I, 1854, p. 300.

Goniobasis deshayesiana (Lea), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 186.

Melania athleta Anthony, Ann. N. Y. Lyc. Nat. Hist., VI, 1854, p. 83, pl. 2, fig. 1; Binney, Check List, 1860, No. 23; Reeve, Monog. Melan., 1860, sp. 258; Brot, List, 1862, p. 34.

Goniobasis athleta (Anthony), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 200; Price, Nautilus, XIV, 1900, p. 77.

Melania glauca Anthony, Proc. Acad. Nat. Sci. Phila., XII, 1860, p. 57; Binney, Check List, 1860, No. 125; Reeve, Monog. Melan., 1860, sp. 389; Brot, List, 1862, p. 35.

Goniobasis lyonii Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 266; Journ. Acad. Nat. Sci. Phila., V, 1862, pp. 313–314, pl. 37, fig. 156; Obs. Gen. Unio, IX, 1863, p. 135, pl. 37, fig. 156.

Goniobasis duttonii Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 266; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 314, pl. 37, fig. 158; Obs. Gen. Unio, IX, 1863, p. 136, pl. 37, fig. 158; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 175.

Goniobasis sparus Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 267; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 316, pl. 37, fig. 162; Obs. Gen. Unio, IX, 1863, p. 138, pl. 37, fig. 162; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 197; Hinkley & Marsh, Shells Cent. Tenn., 1885, p. 8.

Goniobasis cerea Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268; Journ. Acad. Nat. Sci. Phila., V, 1862, pp. 321–322, pl. 38, fig. 171; Obs. Gen. Unio, IX, 1863, pp. 143–144, pl. 38, fig. 171.

Goniobasis viridicata Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 322, pl. 38, fig. 172; Obs. Gen. Unio, IX, 1863, p. 144, pl. 38, fig. 172; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 189.

Goniobasis cinerella Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 269; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 328, pl. 38, fig. 184; Obs. Gen. Unio, IX, 1863, p. 150, pl. 38, fig. 184; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 195.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

Within the area under consideration, this species is confined to the Elk River and some of its tributaries. It has been taken here by Mr. Smith, Dr. Ortmann, Messrs. Clench and Remington and, I believe, collectors of an earlier generation.

The Elk River form, taken at or near Fayetteville, Tennessee, is conic, thick, rather rough, light yellowish-brown. The whorls are slightly convex, rounded at the periphery. The spire has numerous, closely set plicae. This is usually the only sculpture, but in some specimens the folds are crossed

by one or two low revolving raised lines near the top of the whorl. The body whorl is smooth. The suture is irregularly impressed; the aperture ovate, white and without bands; the columella narrow, porcelaneous and seldom consisting of more than a wash of callus above the center; the outer lip slightly sinuous. The largest Elk River specimen examined measured 29 mm. by 10½ mm.

An occasional variation is the almost complete absence of plicae. In instances the striae are prominent and numerous. Four of Mr. Smith's shells are reddish-brown. At Rainy Falls, six miles south of Fayetteville, there were taken a few small, dark specimens with the plicae almost obsolete and with a straight, not a sinuous, lip.

Goniobasis laqueata is a species of great variety and of an interesting range. The list of its synonyms is formidable, as will have been observed. For a period of about twenty years every new lot of shells that was received by describing naturalists seemed to them to warrant specific names. The type locality for *laqueata* is Cumberland River. The species occurs to the north of this in the Green River and its streams. I have not seen it from the Cumberland proper, though innumerable of its tributaries contain it. The easternmost locality known is Pitman Creek, Pulaski County, Kentucky, emptying into the Cumberland. The most western locality is Trace Creek, Humphreys County, Tennessee, a small branch of the Tennessee River. The shell appeared in nearly all Dr. Ortmann's extensive collections within the Duck River drainage basin. The Elk River, so far as known, is the extreme southern limit of its range.

Lea's *Melania castanea* was described as "smooth" and then as "disposed also to be striate and plicate." Comparison is made with *clavaeformis* and that apparently is responsible for its being confused with the Goniobases of East Tennessee. The types came from Maury County, Tennessee, whose Goniobases are mostly of the *laqueata* group. In the upper Duck River drainage basin of this same region, Dr. Ortmann took a mollusk that is exactly like *laqueata* in every character except

that it is smooth. Other instances are known in which sculpture disappears in Melanians of headwaters and the original specimens of *castanea* were close to that aspect.

Goniobasis laqueata tortum (Lea)

Melania torta Lea, Proc. Am. Phil. Soc., IV, 1845, p. 165; Trans. Am. Phil. Soc., X, 1848, p. 84, pl. 9, fig. 30; Obs. Gen. Unio, IV, 1848, p. 84, pl. 9, fig. 30; Binney, Check List, 1860, No. 272; Reeve, Monog. Melan., 1860, sp. 377; Brot, List, 1862, p. 39; Goodrich, Nautilus, XLI, 1927, p. 58.

Pleurocera tortum (Lea), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 117.

In this subspecies the very narrow spire is unusually prolonged and the maturing whorls spread out suddenly and widely, giving the shell almost a bottle-like appearance. In texture, the presence of plicae and striae and the occurrence of shouldered whorls the variety is very much like *laqueata.* The aperture, as in the case of the spire, is different. Tryon placed *tortum* under Pleurocera; it is not clear why. I have seen shells from Lynn Creek, Giles County, Tennessee, and Richland Creek, Lawrence County, Tennessee, both streams being in the drainage basin of Elk River. The Richland Creek specimens are in the Marsh collection, now owned by Dr. Bryant Walker. Dr. Ortmann collected in Richland Creek, but apparently below the spot where this subspecies occurs.

Lea's measurements, altered to millimeters, were 23½ by 8½. The shells were from Big Creek, Lawrence County, Tennessee. A specimen from the Marsh collection is 28 mm. by 11½ mm.

Goniobasis acuta (Lea)

Melania acuta Lea, Trans. Am. Phil. Soc., IV, 1830, p. 101, pl. 15, fig. 32; Obs. Gen. Unio, I, 1834, p. 111, pl. 15, fig. 32; IX, 1863, p. 143; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 321; Wheatley, Cat. Shells U. S., 1845, p. 24; Binney, Check List, 1860, No. 4; Reeve, Monog. Melan., 1860, sp. 274; Brot, List, 1862, p. 3.

Ceriphasia acuta (Lea), H. & A. Adams, Genera, I, 1854, p. 297.

Goniobasis acuta (Lea), Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268; Journ. Acad. Nat. Sci. Phila. V, 1862, p. 321; Obs. Gen. Unio,

IX, 1863, p. 143; Tryon, Smithson. Misc. Coll., No. 253, p. 205; Hinkley, Nautilus, XX, 1906, p. 41.

Goniobasis bifasciata Lea, Proc. Acad. Nat. Sci. Phila., XX, 1868, p. 151; Journ. Acad. Nat. Sci. Phila., VI, 1868, p. 331, pl. 54, fig. 7; Obs. Gen. Unio, XII, 1869, p. 91, pl. 54, fig. 7; Walker, Misc. Pub. Mus. Zool., Univ. Mich., 1918, p. 155.

Goniobasis clathrata Lea, Proc. Acad. Nat. Sci. Phila., XX, 1868, p. 151; Journ. Acad. Nat. Sci. Phila., VI, 1868, p. 331, pl. 54, fig. 8; Obs. Gen. Unio, XII, 1869, p. 91, pl. 54, fig. 8; Walker, Misc. Pub. Mus. Zool., Univ. Mich., 1918, p. 156.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

This is a fine, delicate shell, ordinarily thin, narrow and with sculpture that on the spire consists of closely set plicae crossed by a few, revolving raised lines. The periphery of the young and the not quite mature specimens is angulated; of the older ones, rounded. The aperture is white, ovate; the columella narrow and rounded; the outer lip slightly sinuous. Color bands, where they occur, vary from one to five.

The species is related to *edgariana* Lea, but the plicae in *acuta* are not so stout or so widely spaced. They occasionally "synchronize," the folds on one whorl touching those of the next.

The young are carinate, granulate; the base flat and with folds just beneath the periphery, which is carinate.

The type locality is the Tennessee River. The species has been taken at Muscle Shoals by Messrs. Hinkley and Smith, in the Flint River and its tributaries by Mr. Smith and the Rev. Mr. Wheeler, and in Piney Creek, at Mooresville, Limestone County, Alabama, by Mr. Smith. A few small Elk River shells of the Alabama collection that were labeled *G. clavula* Lea are, I believe, nearer to typical *acuta*. I could not find the types in the United States National Museum, but I am confident that the shells later taken near Florence belong to the species.

Among the Flint River shells are specimens that agree perfectly with the description of *G. bifasciata* Lea. They were taken near Gurley in Madison County. I cannot see that

they are entitled to even subspecific rank. Certain other specimens from Flint River correspond to Lea's *G. clathrata.* In both, the plicae and striae of *acuta* are very much emphasized, the plicae standing out prominently and the striae continuing to the base. I do not think the shells are distinct from *acuta.* They appear to occur in colonies containing the typical forms, just as striate individuals are to be found with smooth forms of *virginica.* The separation of mutations has been, of course, the grand multiplier of species.

The operculum of *acuta* is about twice as long as wide. The left margin is firm, slightly curved; the right margin, fragile and widely curved; the base rounded; the apex acute. The spiral lines are on the lower left-hand margin. They are sharply defined, but do not extend toward the right beyond the center of the operculum. In working out the identity of the various forms of this species the operculum has been helpful.

Shell measurements:

Altitude		Diameter	
16½ mm.	×	6½	Tennessee River. (Lea's measurements)
16½	×	6½	Tennessee River, near Florence (Hinkley)
21	×	8	Tennessee River, near Florence (Hinkley)
20	×	7⅞	Small branch, opp. Florence (Hinkley)
21	×	9	Muscle shoals (Smith)
18½	×	7	Muscle shoals (Smith)
24½	×	9½	Flint River, near Gurley (Smith)
24½	×	9	Flint River, near Gurley, *clathrata* (Smith)
13½	×	6¼	Flint River, near Gurley, *bifasciata* (Smith)

Goniobasis acuta clavula Lea

Goniobasis clavula Lea, Proc. Acad. Nat. Sci. Phila., XX, 1868, p. 152; Journ. Acad. Nat. Sci. Phila., VI, 1868, p. 335, pl. 54, fig. 15; Obs. Gen. Unio, XII, 1869, p. 96, pl. 54, fig. 15; Walker, Misc. Pub. Mus. Zool., Univ. Mich., 1918, p. 156.

This is another one of the mollusks that were sent to Dr. Lea by Dr. Spillman from Jackson County, Alabama. It was described as "carinate, sometimes plicate, thin, dark chestnut brown; without bands;" the spire "exserted, acuminate, the sutures regularly impressed." The whorls are "about 8,

flattened; the aperture very small, ovate, within chestnut color; the outer lip acute, the columella white and twisted. * * * Some have striae on the lower part of the whorl." The type measures 13 mm. by 4¼ mm.

Among the shells taken by Mr. Smith in Madison County and close to the Jackson County border is a very thin, elongate form with delicate plicae, striae and carinae. The sculpture is light and confined to the spire and, in some instances, the plicae are absent. Of 41 specimens, 29 are rounded on the periphery, 12 are angled as in typical *acuta*. The form is little, of a shining yellow color and without bands. The largest specimen, which has ten whorls, measures 22 mm. by 7½ mm. Another locality for *clavula*, found by Mr. Smith, is Little Crow Creek, near Anderson, Jackson County.

I think these shells can properly be recognized as a subspecies of *acuta*. The close relationship of the two is not very plain upon cursory examination, but is clear enough after careful comparison.

Goniobasis baculum (Anthony)

Melania baculum Anthony, Ann. N. Y. Lyc. Nat. Hist., VI, 1854, p. 98, pl. 2, fig. 12; Binney, Check List, 1860, No. 27; Reeve, Monog. Melan., 1860, sp. 431.

Goniobasis baculum (Anthony), Lewis, Proc. Acad. Nat. Sci. Phila., 1872, p. 114; Tryon, Smithson. Misc. Coll., No. 253, 1873, pp. 206–207; Walker, Misc. Pub. Mus. Zool., Univ. Mich., 1918, p. 155.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

The species, as it occurs in the area under consideration, is fairly close to *acuta* Lea. It appears to be an intermediate form between *acuta* of the Tennessee and *G. edgariana* Lea of the drainage basin of the Cumberland and Duck rivers.

So far as present collections show, *baculum* is confined to the Elk River and some of its small tributaries. It was taken by Mr. Smith in the Elk at Estill Springs, Tennessee. The specimens at hand are not fully grown. They are elongate, slender, carinate on the spire and above the body whorl they are sculptured with plicae crossed by fine, raised lines. The

body whorl is smooth, the periphery angled and the base, in some instances, bears a few microscopic striations. The form resembles the one of *edgariana* which occurs in the headwaters of Calfkiller River, a branch of Caney Fork in which *edgariana* is the dominant *Goniobasis*. A larger form of *baculum* occurs in Rock Creek at Estill Springs. It is one of the most handsome of the Goniobases. The plicae are strong and extend from spire nearly to base. Mr. Smith sent this out as *thorntonii* Lea, an error which could naturally be made by one lacking the opportunity to study types.

The University of Cincinnati collection has specimens of *baculum* carrying the label, "Elk River, Franklin County, Tennessee." In the Walker collection are specimens taken by Wetherby in Owl Creek, Winchester, Franklin County. Probably the collector was the same in each case.

Dr. Lewis considered *baculum* to be the same as *arachnoidea*. I think the differences between these species are quite clear when material is compared. Further than this, there is a decided difference in the opercula, that of *arachnoidea* linking it with *catenaria* and the operculum of *baculum* showing its relationship with *edgariana*.

The range of the *edgariana* group is from Fentress County, Tennessee (Stearns collection), to the Tennessee River at Florence, Alabama (Hinkley and Smith, collectors). Paul Adams and W. G. Parris have collected it extensively in the Obey River and tributaries of northern Tennessee in recent months. Dr. Ortmann took it in two localities in Duck River. *G. edgariana* itself is very common in the Caney Fork and its streams, belonging, like the Obey River, to the Cumberland system.

Measurements of *G. baculum*:

Altitude		Diameter	
20 mm.	×	7½	Elk River, Estell Springs
18	×	7	Elk River, Estell Springs
30	×	10	Rock Creek, Estell Springs
28	×	9½	Elk River, Franklin Co., Tenn.
25½	×	8½	Elk River, Franklin Co., Tenn.

Goniobasis interveniens Lea

Goniobasis interveniens Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268; Journ. Acad. Nat. Sci. Phila., V, 1863, p. 320, pl. 38, fig. 169; Obs. Gen. Unio, IX, 1863, p. 142, pl. 38, fig. 169; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 170; Hinkley, Nautilus, XX, 1906, p. 41.

Goniobasis amoena Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 323, pl. 38, fig. 175; Obs. Gen. Unio, IX, 1863, p. 145, pl. 38, fig. 175; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 169.

Goniobasis continens Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 321, pl. 38, fig. 170; Obs. Gen. Unio, IX, 1863, p. 146, pl. 38, fig. 170; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 188.

Goniobasis proletaria Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 326, pl. 38, fig. 177; Obs. Gen. Unio, IX, 1863, p. 147, pl. 38, fig. 177.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

The outstanding characteristic of this species is the occurrence of stout, longitudinal folds which are rather widely spaced and tend to "synchronize," that is, the folds of one whorl frequently touch those of another, giving the effect of a nearly straight, continuous raised line from spire to body whorl.

A typical specimen is carinate, striate and plicate upon the spire. The carinae are at the periphery; the striae, when present, are at the top of the whorl and are seldom more than two in number. The plicae are prominent and cover the whole upper half of the whorl. They are not always present below the spire. The whorls, as a rule, are flat above the periphery on the lower whorls and the periphery itself is bluntly angled. The columella is white, delicate, and rounded; the aperture ovate to rhomboidal and produced at the base; the outer lip slightly incurved just below the suture. About 25 per cent. of the shells examined are banded, these color bands varying from one at the top of the whorl to five, in which case two occur above the center, one at the center and two below it. In the operculum the spiral lines are fine, clear-cut, and not very openly coiled. They are confined to the lower left margin.

Variation is considerable. Though most of the shells are conic or pyramidal, many are cylindrical or bullet-shaped. In the oldest shells, the periphery is regularly rounded rather than angled. The sculpture may be very prominent or may amount to little and be confined to the apex. The contrast between the brown monotoned shells and those with bright color bands is so great that, superficially, the specimens appear to be of different species. Mr. Smith took *interveniens* of a short, thick, flat-whorled, heavily plicate form which corresponds exactly to Lea's *amoena.* Professor Toumey sent Lea the specimens to which he gave different names. They were described at the same time, upon the same page and, in each case, North Alabama was given as the locality.

The types of *continens* are close to *interveniens,* though they are slightly more pyramidal than the average specimen of that species. However, individuals corresponding to this form are fairly common among the shells taken by Mr. Smith. It is not improbable that Professor Toumey took *interveniens, amoena,* and *continens* from the same colony. Another described species which may safely be included under *interveniens* is *proletaria* Lea. It was credited to "Florence, Alabama River," an error of a kind not rare to Dr. Lea.

The species that *interveniens* most closely resembles is *curreyana* Lea. The two are alike in that their plicae are stout, widely spaced, and frequently "synchronized." The aperture is about the same and is marked by the produced base. But *curreyana* is more slender than *interveniens,* the plicae are more persistent and the outer lip is more sinuous. Old specimens of *curreyana* tend to become cylindrical; the mature *interveniens,* ventricose.

The range of *curreyana* is from the Green River and its tributaries to a few streams of the Cumberland in the neighborhood of Nashville. In some cabinets, *curreyana* is labeled as from the Cumberland at Burnside, Pulaski County, Kentucky. I have learned that this was due to a mixing of labels of shells from Cumberland River and Barren River (of the Green River). *Goniobasis interveniens* occurs in Shoals and

Cypress creeks and in the Tennessee River, all in the vicinity of Florence.

Lea's measurements for the species are, in millimeters, 18½ by 8. The largest taken by Mr. Smith was 26 mm. by 10 mm. A type shell of the *amoena* form was 15 mm. by 7½ mm. An average of fifteen specimens of *interveniens* which appear to have reached maturity and have not suffered much erosion was found to be 23½ mm. by 9 mm.

Goniobasis pybasii Lea

Goniobasis pybasii Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 266; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 313, pl. 37, fig. 157; Obs. Gen. Unio, IX, 1863, p. 135, pl. 37, fig. 157; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 177; Hinkley, Nautilus, XVIII, 1904, p. 40.
Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

This species, the type locality for which is Tuscumbia, does not appear to have been collected in recent years. The Alabama Museum of Natural History has only nine specimens. They came from the Mohr and Calkins and an unnamed collection. Though the amount of material is small, it so nearly meets the description given by Dr. Lea that no doubt is entertained the shells are *pybasii*.

The chief characteristic of the species is that, unlike the other plicate Goniobases of the region, it lacks the granulate spire and the usual revolving raised lines. The plicae are light and closely set. The upper whorls are carinate on the periphery, but the periphery of the body whorl is rounded. Sutures are rather deeply impressed. The outer lip is quite sinuous. Lea says that his specimens have four color bands, the two middle ones being approximate, and that in some shells there is an indistinct fifth band. Of the nine shells of the Alabama collection, only three have bands and in one specimen alone does the number reach four. Most of the material is light yellowish-brown. One is dark enough to be termed reddish-brown. The species is very like *G. carinocostata* Lea of the Alabama River drainage and possibly at Tus-

cumbia it represents an intrusion from the southeast, as is the case with *G. nassula.*

The measurements given by Lea are, in millimeters, 20½ altitude by 7¾ diameter. A heavy, rather ventricose specimen which I have measured is 22½ mm. by 11 mm. An average adult is 21 mm. by 8 mm.

Goniobasis perstriata (Lea)

Melania perstriata Lea, Am. Phil. Soc., V, 1852, p. 252; Trans. Am. Phil. Soc. X, 1852, p. 296, pl. 30, fig. 2; Obs. Gen. Unio, V, 1852, p. 296, pl. 30, fig. 2; Binney, Check List, 1860, No. 203; Brot, List, 1862, p. 36.

Goniobasis perstriata (Lea), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 166; Wheeler, Nautilus, XXV, 1912, p. 126.

Goniobasis nassula var. *perstriata* (Lea), Sargent, Nautilus, VII, 1894, p. 121.

Goniobasis crispa Lea, Acad. Nat. Sci. Phila., XIV, 1862, p. 269; Journ. Acad. Nat. Sci. Phila., V, 1862, pp. 326–327, pl. 38, fig. 180; Obs. Gen. Unio, IX, 1863, pp. 148–149, pl. 38, fig. 180; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 173.

Goniobasis striatula (Lea), Wheeler, Nautilus, XXV, 1912, p. 126.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

An average specimen of this species from Big Spring Creek, Huntsville, Alabama, apparently the type locality, is a rather short, slender, delicate shell, carinated and reddish-brown. Early whorls are sometimes doubly carinate at the periphery. The aperture is small, white or reddish, with an indefinite sinus at the base. The columella is narrow, rounded and with a small twist in it. The outer lip is slightly incurved below the suture. The most striking feature of the shell is its sculpture. This consists of rather low plicae crossed by strong revolving lines. The plicae disappear on the spire and the striae continue to the base. Lea's type measured 20¾ mm. by 7 mm. This seems to be about the usual size of adults from this particular locality, the largest I have seen being 24½ by 9½ mm.

The operculum is large, rather broad, the apex acute and the margins equiangular. The spiral lines are well marked, loosely coiled, and occasionally reach to the right beyond the center of the operculum.

The author's localities for his species were Coosa River and Huntsville, Tennessee. I cannot say that the Coosa River citation is incorrect, though it is doubtful, but "Tennessee" here was, without doubt, a slip of the pen.

The young of *perstriata* are very deeply carinate, two carinae appearing at the periphery; lightly plicate and with from one to four or five raised revolving lines. The base is nearly flat and the sinus is extended to a sharp point.

A study of the variation of *perstriata* takes one so far afield that some of the original characteristics seem altogether lost and to be replaced with new features. In Big Spring Creek there have been taken specimens that are only microscopically striate, some that show no plicae and others that are smooth and shining upon the last whorl. In Bird Spring at Huntsville, Mr. Smith took a comparatively heavy race with greater breadth in proportion to length than the shells of Big Spring Creek. Plicae and striae are of about the same size and where they cross a stippled effect is given to the surface of the shell. This form was named *crispa* by Lea. Of 21 shells of one lot from Bird Spring, 13 are of this character; 2 are striate-plicate on the upper whorls and smooth upon the last one; 1 is striate-plicate on the upper whorls, smooth over most of the last whorl and striate on the base; 1 is slender, attenuate and with the typical sculpture only on the spire and 1 is slender and smooth upon all its surface. A few of these specimens have bands, a heavy one at the top of the aperture and a heavy one at the base, with three light intervening bands. The Graham Spring shells are a rough, heavy series, giving the impression of being deformed. The plicae are rather subdued and the revolving lines are confined to parts of the shell. One specimen is remarkably carinate and has the periphery angulate.

In a "large spring near the Southern Railroad," three miles west of Paint Rock, Jackson County, Mr. Smith took material that, besides showing the typical characters, had in addition a marked tendency to vary decidedly from them. Some shells were plicate-striate only on the spire and plicate

to the periphery of the last whorl. Here the variation was so great that only the presence of a few typical *perstriata* supplied the clue to the true identity. In one lot taken from a spring near Gurley and Paint Rock, Madison County, two thirds were nearly typical, one third were of the form *crispa*. In a second lot from this locality many shells had an angulated periphery.

Goniobasis decampii Lea

Goniobasis decampii Lea, Proc. Acad. Nat. Sci. Phila., XV, p. 154; Journ. Acad. Nat. Sci. Phila., VI, 1866, p. 138, pl. 23, fig. 45; Obs. Gen. Unio, XI, 1867, p. 94, pl. 23, fig. 45; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 210; Wheeler, Nautilus, XXV, 1912, p. 126; Walker, Misc. Pub. Mus. Zool., Univ. Mich., 1918, p. 157.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

This mollusk is *G. perstriata* in all essentials save its nearly cylindrical shape. Quite slender specimens of *perstriata* have been taken in Big Spring Creek at Huntsville, yet none that are so regularly attenuate as *decampii*. It is possible that the original collector, Dr. DeCamp, had visited some spring or creek in the vicinity of Huntsville containing these shells, and that the locality has not since been examined. A "pure culture" of *decampii* would warrant, of course, its definite recognition.

Goniobasis paupercula Lea

Goniobasis paupercula Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 268; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 324, pl. 38, fig. 176; Obs. Gen. Unio, IX, 1863, pp. 146–147, pl. 38, fig. 176; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 192; Price, Nautilus, XIV, 1900, p. 77; Hinkley, Nautilus, XX, 1906, p. 41.

Goniobasis tuomeyi Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 266; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 311, pl. 37, fig. 153; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 169.

?*Goniobasis spillmanii* Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 264; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 302, pl. 37, fig. 138; Obs. Gen. Unio, IX, 1863, p. 134, pl. 37, fig. 138.

?*Goniobasis cruda* Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 270; Journ. Acad. Nat. Sci. Phila., V, p. 332, pl. 38, fig. 190; Obs. Gen. Unio, IX, 1863, p. 154, pl. 38, fig. 190.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

The shell, as taken by Mr. Smith in a branch of Cypress Creek, two miles northwest of Florence, is sparingly plicate and striate upon the spire. The lower whorls are smooth, a little convex; the body whorl rounded, not angulate. Specimens from this locality are without color bands, the color of the epidermis being dark brown. Lea's specimens had the outer lip "slightly sinuous," but in these shells it is straight. In other regards the species has most of the usual characteristics of Goniobases of this region. An uneroded adult would probably have nine whorls. The largest taken in the Cypress Creek tributary—which is probably close to where Hinkley collected *paupercula* in 1904—measures 17 mm. by 6½ mm. A ventricose individual is 14½ mm. by 7 mm. The average of ten shells, fully grown though eroded, is 16 mm. by 6 mm. Lea's type, in millimeters, was 15¾ by 6¾.

Another of Mr. Smith's localities for *paupercula* is Bluewater Creek. The specimens here run as large as 20½ mm. by 9 mm. Of 196 specimens, 31 are banded, the bands being either one or two in number. It was these banded shells that Lea named *tuomeyi*. The outer lips of some are slightly incurved and in several the periphery is angled. In general, the color is lighter than in the form from the branch of Cypress Creek. A very dark, club-shaped form was found in Spring Branch, an affluent of Four-Mile Creek, near Killen. It is more strongly sculptured than material from other places and in no instance do bands occur. The largest specimen measures 21½ mm. by 9 mm. At Burleson, Franklin, Alabama, in a branch of Taylor Creek, Mr. Smith took numbers of *paupercula,* differing little from the shells near Florence. They are not quite so plicate and the striae are often absent. In size, this form does not exceed 14½ mm. by 7 mm. Also near Burleson, in Cave Spring on the east side of Great Bear Creek, was taken a dwarfed form which, like many other species occurring in springs, has experienced a considerable modification of characteristics. All the specimens are plicate, but I could find none that had the revolving raised lines. The largest is 11 mm. by 4½ mm. A mixed lot of

dwarfed, elongate, and typical forms of *paupercula* was taken at Parish Mine, near Russellville, Franklin County. The sculpture varies in strength, but in general the characters are those to be expected of the species. A single specimen from Muscle Shoals is in the Alabama Museum collection. It is light, greenish-brown and much larger than typical examples.

Six specimens of a large, ventricose, dark-brown form is labeled "Brush Creek, near Killen, Lauderdale County." The sculpture is low and clear on only three of the shells. They are all fairly near to the *paupercula* from an affluent of Four-Mile Creek, previously noticed. The largest is 21½ mm. by 11 mm. The form resembles the figure of *G. spillmanii,* a non-plicate shell credited to the Tennessee River. Lea may have received unsculptured shells like this or some with eroded apices, the plicae being lost. Lea's *G. cruda,* also of the Tennessee River, is open to the same suspicion. Lea's *spillmanii* measured 23½ mm. by 9¼ mm. He received only three specimens from the collector, Dr. Spillman. His specimens of *G. cruda* numbered two.

Species in Doubt

Goniobasis formosa (Conrad)

Melania formosa Conrad, New F. W. Shells, U. S., 1834, appendix, p. 5, pl. 9, fig. 3; Wheatley, Cat. Shells, U. S., 1845, p. 25; Binney, Check List, 1860, No. 112.

Goniobasis formosa (Conrad), Tryon, Smithson. Misc. Coll., No. 253, pp. 174, 193; Hinkley, Nautilus, XX, 1906, p. 41.

Ambloxus virginicus (Gmelin), Hannibal, Proc. Mal. Soc., X, 1912, p. 174.

The description:

"Shell with distant, robust, rounded ribs and six convex whorls, with two approximate, prominent lines at the summit of each; base profoundly striated; color olivaceous, with distant, brown bands.

"Habitat.—Inhabits streams of North Alabama."

Tryon considered *formosa* to be close to *nassula* and placed *ornatella* Lea, which is the same as *G. edgariana* Lea, under it as a synonym. Figure 337 in Tryon is not helpful, at

least no more so than the original unsatisfactory description. An author's example in the Lea collection in the United States National Museum is a young and slender *Pleurocera alveare* Conrad. The specimen which Reeve illustrated as *M. formosa* Anthony is not the same as this, though there is reason to believe that it was the identical shell that Tryon used for making the figure of Conrad's *formosa*.

In such a confusion the only practical way out is to go back to Conrad's types. I cannot learn that any exist.

Goniobasis gouldiana Lea

Goniobasis pulchella Lea, Proc. Acad. Nat. Sci. Phila., XX, 1868, p. 151 (preoccupied).

Goniobasis gouldiana Lea, Journ. Acad. Nat. Sci. Phila., VI, 1868, p. 332, pl. 54, fig. 9; Obs. Gen. Unio, XII, 1869, p. 92, pl. 54, fig. 9; Walker, Misc. Pub. Mus. Zool., Univ. Mich., 1918, p. 158.

The two specimens of *gouldiana* came from North Alabama, Dr. Spillman, collector. All that the author had from which to make his description was the spires, the rest of the shells being broken away. Nevertheless, Dr. Lea went confidently ahead and described the aperture, the columella and the outer lip. One might as well attempt to tell from the flagstaff on the schoolhouse what the main door is like.

Goniobasis trochiformis (Conrad)

Melania trochiformis Conrad, New F. W. Shells U. S., 1834, p. 56, pl. 8, fig. 11; Muller, Synopsis, 1838, p. 47; De Kay, Moll. N. Y., 1843, p. 100; Wheatley, Cat. Shells U. S., 1845, p. 27; Binney, Check List, 1860, No. 275; Brot, List, 1862, p. 47.

Goniobasis trochiformis (Conrad), Tryon, Smithson. Misc. Coll., No. 253, p. 216.

Tryon thought that this would probably "prove to be identical with Mr. Anthony's *T. cristata*," meaning *M. cristata*. The description and figure indicate that the species, if a good one, belongs to the group of *Pleurocera canaliculatum* (Say).

Goniobasis gabbiana Lea

Goniobasis gabbiana Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 265; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 304, pl. 37, fig. 141; Obs. Gen. Unio, IX, p. 126, pl. 37, fig. 141; Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 268.

The author had only two shells upon which to base this species, one from Tennessee, the other from Alabama. The Tennessee specimen is apparently the one taken as the type; at least it is the one described. I believe it to be the same as *G. clavaeformis* Lea. It is mentioned in the description that the Alabama specimen, unlike the one from Tennessee, is plicate and striate. I could not find it in the United States National Museum and cannot say personally whether it is entitled to specific rank or belongs to a species previously described, which is likely.

Goniobasis semicostata (Conrad)

Melania semicostata Conrad, New F. W. Shells U. S., 1834, appendix, p. 7, pl. 9, fig. 6; Binney, Check List, 1860, No. 24; Brot, List, 1862, p. 59.

Goniobasis semicostata (Conrad), Tryon, Smithson. Misc. Coll., No. 253, 1873, p. 191; Hinkley, Nautilus, XVIII, 1904, p. 40.

"Shell elevated; longitudinally ribbed; whorls convex with fine spiral striae; body-whorl without ribs, obscurely striated above, subangulated in the middle; aperture large, obliquely elliptical; within bluish, with brown bands. Inhabits streams of North America."

I do not recognize the species. As Hinkley indicates, it may be a mollusk of the Alabama River basin.

Goniobasis fabalis Lea

Goniobasis fabalis Lea, Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 266; Journ. Acad. Nat. Sci. Phila., V, 1862, p. 311, pl. 37, fig. 154; Obs. Gen. Unio, IX, 1863, p. 133, pl. 37, fig. 154; Tryon, Smithson. Misc. Coll., No. 253, p. 305.

This species was described as from the Tennessee River. This is probably a mistake. The shells appear to be of the kind peculiar to the Coosa River.

Species Possibly New

The three forms discussed below belong to the Alabama Museum collection and are unrecognizable as species already described. Yet inasmuch as the region dealt with in this paper has been pretty well examined by collectors who sent their material to describing naturalists, it has seemed to be inadvisable to name these shells lest, upon more thorough study of the large collections, the new names may have to go into the synonymy.

Goniobasis sp.

Dry Creek, branch of Paint Rock River, Trenton, Jackson County, Alabama; Paint Rock River, two miles above Trenton; branch of Crow Creek, at Bass, Jackson County, Alabama; Spring Branch, MacMahon's Cove, northeast of Stevenson, Jackson County, Alabama.

This is a small yellowish-brown, club-shaped shell, its whorls slightly convex, the sutures impressed, the periphery rounded. On the spire are a few obscure striae, very often absent. The aperture is about one half the length of the shell. It is slightly produced at the base. Columella narrow, white, rounded; outer lip nearly straight.

An average adult specimen is 17 mm. by 8 mm. The largest seen is 21 mm. by 9 mm. I have myself taken identical material in Battle Creek, Sweden Creek and Little Sequatchie River, all of Marion County, Tennessee. This is the first county north of Jackson County, Alabama. The description which most nearly fits this form is that of *G. angulata* (Anthony). The type specimen in the Museum of Comparative Zoology is young and wanting in any definite characters.

Goniobasis sp.

Spring, one mile north of Princeton, Jackson County, Alabama. Paint Rock River drainage.

Shell: Ventricose, yellow-brown, obscurely plicate, angulated at the periphery; aperture large and with a prominent

sinus at the base. Four whorls. This is the largest of two specimens. Many species occurring in springs take on unfamiliar phases.

Goniobasis sp.

Huntsville, Alabama.

The upper whorls of this one specimen are carinate and without plicae or striae. The body whorl is subangulated at the periphery; the aperture elongate-ovate, about half the length of the shell and produced at the base. There are four color bands, two above the center, one at the periphery and one below it. The columella is narrow, rounded; the outer lip straight. The whole shell is dark, yellowish-brown. The specimen is particularly of interest because it is the only smooth form of *Goniobasis* which has been taken at Huntsville.

Misplaced Species

Tryon has included *Melania grisea* Anthony among the Goniobases. It came from the Tennessee River, North Alabama. A specimen specifically distinguished as type was not seen during my examination of the Anthony Pleuroceridae in the Museum of Comparative Zoology. It may have been overlooked. Specimens with the name were in the collection marked "labelled for exchange." These were all young Lithasiae, apparently *L. florentiana* (Lea). *Melania procissa* Anthony, from Alabama, was also placed by Tryon under *Goniobasis,* though with less confidence. It is a small shell principally characterized by five stout costae on the body whorl. Only one specimen was known to Anthony. Mr. Smith collected a single shell on Muscle Shoals that seems to be quite like it. It is a specimen of *Lithasia verrucosa* (Raf.) in which the nodules have coalesced into continuous raised lines. *Goniobasis stewardsoniana* Lea was named for two individuals of the same kind that were collected at Knoxville, Tennessee. *Goniobasis auricoma* Lea, taken by Dr. William Spillman in the Tennessee River, was named from one specimen only. This type belongs to *Lithasia,* possibly *L. verrucosa.*